

REMARKS

Favorable consideration of the present application is respectfully requested.

Claims 1 and 5 have been amended herein in an attempt to better define certain important aspects of the invention. The limitation added to these two independent claims by this Amendment places the claims in a form and scope not previously subject to examination. These claims are believed to patentably define the invention over the references cited in the parent application.

In the parent application, Claims 1-20 had been rejected under 35 USC §103(a) as being unpatentable over the disclosures of aluminum alloys 356.0 and 357.0 in the ASM Handbook: Vol. 2 Properties and Selection: Nonferrous Alloys and Special-Purpose Materials ("ASM Handbook"), as well as other portions of the ASM Handbook dealing with aluminum foundry products in general. Claims 1-20 were also rejected under 35 USC §103(a) as being obvious in view of the combined teachings of JA53-16312 and page 133 of the ASM Handbook. It is respectfully submitted that Claims 1 and 5 as now presented are patentable over these references.

The basic premise of the two grounds of rejection is that the ASM Handbook, specifically the disclosure of Alloy 356.0 and 357.0, and JA53-16312, each discloses alloy compositions which overlap the composition as recited in previous Claims 1 and 5. It is further asserted that the solution heat treatment and aging times and temperatures set forth in the ASM Handbook and in JA53-16312 are essentially the same as those set forth in certain dependent claims in the present application.

The grounds for rejection specifically acknowledge that, "the prior art does not teach the solidification rate of the casting or what phases are present as a result of the above mentioned process steps". However, it is asserted that it is "well known to one of ordinary skill in the art to solidify castings at rapid rates in order to produce a high quality casting with small DAS [dendrite arm spacing]". Page 133 of the ASM Handbook is cited as evidencing this knowledge attributed to those of ordinary skill in the art.

Even though the prior art admittedly does not teach which phases are present in the final (and intermediate) alloys disclosed, it was concluded that, because the prior art discloses substantially the same alloy processed in substantially the same steps (referring to a solution treatment at 540° C. for 2 or more hours, as disclosed in the present specification with respect to an alloy containing Mg), then substantially the same product would result. This is asserted to establish a prima facie case of obviousness, in the absence of evidence to the contrary.

On this latter issue, Applicant believes that evidence to the contrary exists in the very references relied upon in rejecting the claims. The references collectively demonstrate that persons of ordinary skill in the art do not employ broad, sweeping general conclusions regarding what processing steps are considered "substantially the same". In the two grounds of rejection, the Examiner asserts that both the solution heat treatment for the 356.0 alloy (@535-540° C.) and for the alloy in JA53-16312 (545-555° C.) are "substantially the same" as that used for the alloy of the present invention. However, it is clear from JA53-16312 that the solution heat treatment employed therein is not regarded as being substantially the same as the

conventional A356.0 solution heat treatment. The English language abstract of JA53-16312, and portions of the specification which can be understood, clearly evidence that the solution heat treatment set forth therein (545-555° C.) was considered to be inventively different from the "usual" solution treatment (see Col. 2, line 1, of JA53-16312) used for A356 alloys.

This evidence of the level of skill in the art and the understanding of those of ordinary (or possibly extraordinary) skill in the art directly refutes the conclusion that the various cited references and the specification in the present invention disclose "substantially the same" solution heat treatment process steps. Thus, the attempt to shoehorn an anticipation/inherency rationale into an obviousness rejection is not proper. That, combined with the admission that the cited prior art does not disclose what phases are present in the alloy, can lead only to the conclusion that it would not have been obvious to persons of ordinary skill in the art to produce the claimed alloy, in which the sole or predominant iron-containing phase is β phase that has formed as a transformation product of the π phase. There is no evidence of record indicating that persons of ordinary skill were taking this into account. Rather, as evidenced in the present specification, both the β and π phases were seen as being detrimental to mechanical properties (p. 3, lines 12-13), and, when those deleterious effects were to be reduced or eliminated, those skilled in the art took measures to eliminate the π -phase (rather than transform it to β phase), by the addition of beryllium, for example. The rejection of Claims 1 and 5, and all claims depending therefrom, is therefore improper and should be withdrawn.

In a similar vein, the grounds for rejection improperly attempt to graft some very general teachings relating to aluminum foundry alloys, to the disclosures of specific types of alloys, in reaching the conclusion that the invention set forth in prior Claims 1-20 would have been obvious to a person of ordinary skill in the art. This is even more the case when now considering Claims 1 and 5 as amended herein.

The Official Action cites to page 133 of the ASM Handbook as standing for the proposition that it is well known to persons of ordinary skill in the art that high quality castings with small DAS are produced by solidifying the casting at rapid rates. From this statement of general trend, which is directed to all "aluminum foundry products" (which is the title of the relevant section in the ASM Handbook), it is then asserted that it would have been obvious to employ a high solidification rate in casting the 356.0, 357.0, the JA53-16312, or, apparently, any other "aluminum foundry product". At most, the disclosure at page 133 might make it "obvious to try" using a high solidification rate for a given alloy, such as the one claimed in the present invention. Something which may be "obvious to try", is not, however, "obvious" according to the case law precedent identifying the standards dictated by 35 USC §103(a).

Indeed, Figure 1 of the present specification, which illustrates the effects of composition and solidification rate on a parameter referred to as the "Quality Index" (a measure of strength and elongation) evidences that high solidification rates do not necessarily produce the best quality for all "aluminum foundry alloys". Figure 1 evidences, in fact, that low solidification rates, which produce a dendrite arm spacing of about 60 μm , produce the highest quality (Quality Index) casting for the aluminum alloys under

investigation having a magnesium content of 0.25-0.30 weight percent. This would include, incidentally, a considerable portion of the range of alloys covered by the 356.0, A356.0 and JA53-16312 specifications cited against the claims in this application.

The data shown in Figure 1 contradicts the "faster is better" generalization regarding solidification rates set forth at page 11 of the ASM Handbook for aluminum foundry alloys of all types, and thus evidences that the "faster is better" approach is not one which would be followed blindly by persons of ordinary skill in the art. Accordingly, reliance on this generalization in rejecting the claims previously presented was improper, and is improper with respect to the claims as currently presented.

Each of Claims 1 and 5, as amended herein, sets forth two additional significant claim limitations which aid in better defining the invention over the prior art. The magnesium content in Claims 1 and 5 has been changed to the range of 0.40-0.45 weight percent. In addition, Claims 1 and 5 now each contain a limitation directed to the range of the dendrite arm spacing (10-45 μm DAS) which has been demonstrated to provide the best quality (reference the "Quality Index") for these alloys. The specific advantages of these limitations are set forth in the paragraph commencing at line 4 of page 6 of the specification (the claimed magnesium range); and at page 7, lines 13-15, and page 9, lines 32-36 (the claimed DAS).

The use of an alloy having from 0.40-0.45 weight percent magnesium was found to provide the best combination of strength and elongation, which are the two property parameters used in calculating the "Quality Index" represented on the y-axis of the graphs of Figure 1. The processing of the

alloy during solidification to yield a 10-45 μm DAS is important in achieving the desired π phase to β phase transformation.

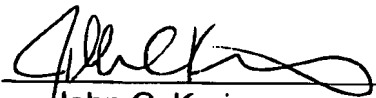
With the amendment to the range of magnesium, Claims 1 and 5 now only touch upon the 357.0 alloy at its lower end and the JA53-16312 at its upper end. The Mg content as claimed overlaps only an upper portion of the Mg content of the 356.0 and A356.0 alloy ranges. In view of (1) the deficiencies and utter lack of specificity in the teachings of the prior art in the aspects of solidification cooling rates with respect to certain alloys; (2) the lack of any clear direction in terms of solution heat treatments, as evidenced in JA53-16312, which essentially discards traditional solution heat treatments of alloy 356.0; and (3) the utter lack of any teaching regarding an ability to improve mechanical properties by obtaining a complete or substantial transformation of iron-containing π phase impurities to β phase impurities; the superficial similarities between the claimed alloy and method, and the teachings of the cited references can not be said to establish a prima facie case of obviousness with respect to Claims 1 and 5 as now presented.

In view of the foregoing, it can be seen that Claims 1 and 5 are patentable over the cited ASM Handbook alone or in combination with JP53-16312. Reconsideration of the prior rejections, and withdrawal of the same,

are respectfully requested. Passage of the application to issue at an early date is earnestly solicited.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

1. (Amended) An alloy which comprises:

Si : 6.5 - 7.5 wt%

Fe: up to 0.20 wt%

Cu : up to 0.05 wt%

Mn : up to 0.05 wt%

Mg : [0.35 to 0.50] 0.40 to 0.45 wt%

Zn : up to 0.05 wt%

Ti : up to 0.20 wt%

and the balance Al and other components, wherein said other components comprise a total of not more than 0.15 wt% of said alloy and any single component of said other components does not exceed 0.05 wt% of said alloy, the alloy having a microstructure which includes a primary aluminum-containing matrix and one or more iron-containing phases dispersed in the matrix, [and] wherein the sole or predominant iron-containing phase is β phase that has formed as a transformation product of π phase and wherein the matrix has a dendrite arm spacing of between 10 and 45 μm .

5. (Amended) A method for manufacturing an alloy article comprising the steps of:

(a) providing a melt having a composition of:

Si : 6.5 - 7.5 wt%

Fe: up to 0.20 wt%

Cu : up to 0.05 wt%

7 Mn: up to 0.05 wt%

8 Mg : [0.35 to 0.50] 0.40 to 0.45 wt%

9 Zn: up to 0.05 wt%

10 Ti : up to 0.20 wt%

11 and the balance Al and other components, said other components
12 comprising a total of not more than 0.15 wt% of said alloy and any single
13 component of said other components not exceeding 0.05 wt% of said alloy,

14 (b) casting said melt and solidifying a casting at a cooling rate that
15 produces a microstructure of an aluminum-containing matrix and π and β iron-
16 containing phases dispersed in the matrix, wherein the cooling rate on
17 solidification is sufficient to produce a dendrite arm spacing in the matrix of
18 between 10 and 45 μm ;

19 (c) solution heat treating the casting to at least partially transform π
20 phase to β phase; and

21 (d) quenching the casting to form the alloy article.